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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/038,680	01/08/2002	Yoshihiro Sotome	900-410	8985

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EXAMINER
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LEE, CALVIN

ART UNIT	PAPER NUMBER
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2825

DATE MAILED: 09/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/038,680

Applicant(s)

SOTOME, YOSHIHIRO

Examiner

Lee Calvin

Art Unit

2825

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## OFFICE ACTION

### *Opening Comments*

1. After a closer review of the cited prior art and after considering the comments forwarded by the applicant in the Amendment, the examiner has found the applicant's arguments on the art to be persuasive. However, the examiner has found a new piece of art (US 5,883,418), which would read on the applicant's claims. Therefore, the rejections based upon this reference are new grounds of rejection and this action does not constitute a final rejection of the pending claims.

### *Claim Rejections - 35 U.S.C. § 103*

2. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Kimura* (US 5,883,418) in view of *Iinuma et al.* (US 5,989,988).

a) In re claims 1-3, 10-16, *Kimura* discloses a method of manufacturing a semiconductor device, comprising the steps of:

- forming a titanium film **43** having a reducing property on a semiconductor substrate **1** [Fig. 30]
- thermal treating the substrate to form a first silicide **40**, **16a**, **16b** on active regions and top portions of the gate electrodes **4** [col. 10, ln.51 through col. 11, ln.50]
- removing any unreacted titanium film on the gate sidewalls [Fig. 31 and col. 10, ln.18]
- forming a cobalt film **45** on the first silicide [Fig. 32]
- thermal treating the substrate to form a second silicide **41** which includes a region where the first silicide was formed [Fig. 22]

However, *Kimura* is silent about such heat treatment for reducing a native oxide film naturally formed on the substrate. It would have been obvious to one having ordinary skill in the art to have modified the process of *Kimura* by utilizing the claimed functional recitation because it is notoriously well known in the art as seen by the plethora of *Iinuma et al*'s reference teaching "cobalt...titanium in the capability of reducing a silicon oxide film" [cols. 2-3].

Moreover, Applicant is reminded that the functional recitation, unless being expressed as a "means" for performing the specified function (as set forth in 35 USC § 112 6th paragraph) and supported by recitation in the claim of sufficient structure to warrant the presence of the functional language, has not been given patentable weight because it is narrative in form. *In re Fuller*, 1929 C.D. 172; 388 O.G. 279.

b) In re claim 4, *Kimura* fails to disclose the treatment temperature. However, *Iinuma et al* suggests an annealing treatment at about 550° [col. 8].

It would have been obvious to one having skill in the art to have modified the heat treatment of *Kimura* by utilizing the claimed heat temperature because one would apply a low temperature in the thermal treatment to result a most effective metal monosilicide.

c) *In re* claims 5 and 6, *Kimura* fails to disclose thickness of the metal films. *Iinuma et al* suggests that cobalt and/or titanium film has a thickness of 10nm, 15nm, or 20nm [col. 9].

It would have been obvious to one having skill in the art to have modified the process of *Kimura* by utilizing claimed film thickness because a thin silicide is required for a semiconductor gate having shorter gate length [see *Applicant's Prior Art*, page 2].

d) *In re* claims 7 and 8, *Kimura* does not teach the step of forming a titanium nitride film after the step of forming the second metal film. Nevertheless, such protection film formation is known in the semiconductor processing art as evidenced by *Iinuma et al* disclosing that a titanium nitride film 9 is formed on the cobalt film 8 [Fig. 1B and col. 8, ln. 20].

It would have been obvious to one having skill in the art to have modified the process of *Kimura* by utilizing a protective film on the metal film subjected to silicide for the purpose of obtaining the effect of improving the heat resistance of the silicide film [col. 11, ln. 44].

e) *In re* claim 9, *Kimura* does not teach the step of oxidizing the substrate in a mixed solution of hydrochloric acid, hydrogen peroxide and water before the step of forming the first metal film. *Iinuma et al* teaches or suggests that a substrate surface treatment (using a mixed solution of hydrochloric acid, hydrogen peroxide and water) results a thin native oxide film 30 uniformly formed on the metal film [col. 8, ln. 17].

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of *En* by utilizing a native oxide formation for the purpose of obtaining a single crystalline cobalt disilicide film [col. 11, lns. 27-33].

Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at (703) 306-5854 from 7 to 17 ET (Monday through Thursday). If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2825's Supervisory Patent Examiner *Matthew Smith* can be reached at (703) 308-1323.

Any inquiry relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0596. The fax phones are (703) 872-9318 for regular communications and (703) 872-9319 for After-Final communications.

CL

August 18, 2003

*C. Everhart*  
CARIDAD EVERHART  
PRIMARY EXAMINER